

Reply to Office Action dated May 8, 2006

REMARKS

Claims 1-17 and 31-43 are pending in this application. By this Amendment, claims 11-12, 14, 17 and 31 are amended. Various amendments are made for clarity and are unrelated to issues of patentability.

Entry of the amendment is proper under 37 C.F.R. §1.116 because the amendments: (1) place the application in condition for allowance; (2) do not raise any new issues requiring further search and/or consideration; (3) satisfy a requirement of form asserted in the previous Office Action; and/or (4) place the application in better form for appeal, should an appeal be necessary. More specifically, the above amendments are merely for clarity. No new issues are raised. Entry is therefore proper under 37 C.F.R. §1.116.

The Office Action rejects claims 1-17 and 31-43 under 35 U.S.C. §103(a) by U.S. Patent 6,653,741 to Sreeram et al. (hereafter Sreeram) in view of U.S. Patent Publication 2002/0079355 to Totino. The rejection is respectfully traversed with respect to the pending claims.

Independent claim 1 recites bonding a thermal interface material layer including a metallic solder to the bonding surface, the thermal interface material layer to thermally couple the heat dissipating member to a heat conducting component by an impermanent attachment. Independent claim 1 further recites the bonding including providing at least the thermal interface material in a vacuum chamber under vacuum conditions and heating the thermal interface material in the vacuum chamber to form liquid metallic solder.

As will be discussed below in detail, applicants respectfully submit that the Office Action does not establish a *prima facie* case of obviousness with respect to the pending claims.

Reply to Office Action dated May 8, 2006

Additionally, the combination of references in the Office Action is based on impermissible hindsight, and therefore the rejection should be withdrawn at least for this reason.

More specifically, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must be found in the prior art, not in applicant's disclosure. See MPEP §2143 and *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Applicants respectfully submit that the Office Action fails to meet these three criteria for a *prima facie* case of obviousness. That is, there is no suggestion or motivation in the applied references to modify Sreeram's disclosure so as to include the features of Totino. Still further, there is no reasonable expectation of success when combining Sreeram and Totino as alleged. Still further, applicants respectfully submit that Totino relates to non-analogous art from Sreeram and the present application. Therefore, applicants respectfully submit that the Office Action fails to make a *prima facie* case of obviousness and the rejection should be withdrawn at least for this reason.

The Office Action (on page 10) states that it would have been obvious to modify Sreeram to include a vacuum chamber with an inert gas atmosphere and pressure (as in Totino). The Office Action cites reasons provided within Totino in order to provide this modification.

Reply to Office Action dated May 8, 2006

Applicants respectfully submit that Sreeram and Totino relate to completely different features and therefore the combination would not have been obvious to one skilled in the art.

More specifically, Sreeram relates to a thermal interface material for electronic packaging. As one example, Sreeram discloses use of a TIM that includes solder to allow the TIM to bond to a substrate, such as a semiconductor and/or a heat component. See Sreeram's col. 3, lines 26-30. Sreeram further discloses that solder may melt at a temperature preferably less than about 300°C. That is, Sreeram specifically discloses a preferred melting point of between 160° and 115°C and that the TIM should bond at a temperature less than the failure rate of an active electronic device (such as a semiconductor). Sreeram describes the failure rate of the active (electronic) device as below about 350°C (and more preferably below about 200°C). See col. 3, lines 31-42.

In stark contrast, Totino relates to applying an anti-metallic coating on a steel plate. See Totino's Abstract. Totino describes that these features are provided for storage chambers, tanks, heat exchangers, mixers, treatment devices and rotating devices. See Totino's paragraphs [0001]-[0002]. Totino's whole disclosure specifically relates to the anti-metallic coating on a steel plate. Additionally, Totino discloses heating of an assembly 5 up to a brazing temperature of a brazing material. See paragraph [0022]. As one example, the brazing temperature is typically between 1000°C and 1050°C. See paragraph [0032].

Thus, Sreeram and Totino clearly relate to different operations utilizing different structures and/or temperatures. For example, the Office Action's combination of these references as alleged in the Office Action would suggest to heat semiconductor devices (as in

Reply to Office Action dated May 8, 2006

Sreeram) up to temperatures exceeding 1050°C (as in Totino). Applicants believe that heating of semiconductor devices at such a temperature may cause permanent damage to the semiconductor device. See, for example, Sreeram's disclosure at col. 3, lines 31-35 relating to a failure temperature of a semiconductor. As is expressly stated in MPEP §2143.01, if the proposed modification would render the prior art being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In the present example, the Office Action proposes to modify Sreeram's handling of a TIM to include heating at extreme temperatures. This is clearly improper. Applicants further submit that there is no motivation to modify Sreeram's handling of TIM so as to reach the claimed features.

Applicants further believe that the Office Action's attempt to combine Totino and Sreeram is clearly based on impermissible hindsight as the references, and most particularly Totino, is to a non-analogous art (with respect to both the present application and to Sreeram). Accordingly, applicants respectfully submit that there is no motivation to combine Sreeram and Totino as alleged in the Office Action in order to find the claimed features. The Office Action (on page 10) states that the suggestion to combine the references is in order to establish a mechanical link between the layers, enhance the strength of the bonding process, and so that the support and coating are tightened against each other to compress the brazing material. However, these alleged reasons result from Totino's procedure which clearly do not relate to the art of Sreeram (and that of the present application). Thus, the Office Action's motivation is without merit to one skilled in the art. Further, the Office Action's citation (on page 10) to paragraphs

Reply to Office Action dated May 8, 2006

[0033] and [0034] do not relate to the overall features of Totino that are relied upon in the Office Action.

Applicants believe that such a modification would clearly destroy the express purpose of Sreeram. Further, applicants believe that heating to the temperatures discussed in Totino would clearly cause damage to Sreeram's devices. Therefore, applicants believe that such modification would destroy the express purpose of Sreeram, namely, the providing of a TIM in an electronic device such as a semiconductor. In view of these features, applicants respectfully submit that the Office Action fails to make a *prima facie* case of obviousness with respect to the combined Sreeram and Totino references.

Sreeram does not teach or suggest the claimed bonding of the thermal interface a material layer to the bonding surface (of the heat dissipating member) where the bonding includes providing at least the thermal interface material in a vacuum chamber under vacuum conditions and heating the thermal interface material in the vacuum chamber to form liquid metallic solder as recited in independent claim 1. There is no suggestion in the known prior art for providing a thermal interface material in a vacuum chamber under vacuum conditions and heating the thermal interface material in the vacuum material. As discussed above, Sreeram may not be modified by Totino as alleged in the Office Action. Thus, applicants respectfully submit that the applied references do not teach or suggest all the features of independent claim 1. Thus, independent claim 1 defines patentable subject matter.

Independent claim 15 recites placing a metallic solder and a heat dissipating member having a bonding surface into a vacuum chamber, and placing the vacuum chamber under

Reply to Office Action dated May 8, 2006

vacuum conditions. Independent claim 15 also recites heating the metallic solder to a temperature of greater than or equal to the melting point of the metallic solder to form a liquid metallic solder, providing a pressurized inert atmosphere in the vacuum chamber and disposing the liquid metallic solder on at least a portion of the bonding surface to form a liquid metallic solder layer. Still further, independent claim 15 recites removing at least a portion of the pressurized inert atmosphere from the vacuum chamber, and allowing the liquid metallic solder layer to cool to a temperature of less than the melting point of the metallic solder.

For at least similar reasons as set forth above, the applied references do not teach or suggest at least these features of independent claim 15. The Office Action discusses independent claim 15 on pages 5-7. The Office Action states that Sreeram does not disclose a vacuum chamber with an inert environment under vacuum conditions. The Office Action then appears to rely on Totino for the missing features of independent claim 15. However, Totino's cited paragraphs [0020], [0021] and [0029] do not suggest all the missing features. Rather, the cited paragraphs merely relate to a vacuum chamber having means of heating 11, forming a vacuum or replacing the atmosphere in the chamber with an inert gas and applying mechanic pressure before and/or during the reheating. However, these cited features do not relate to the specific features involving a metallic solder and a heat dissipating member having a bonding surface. Further, these cited sections do not relate to Sreeram's TIM and/or semiconductor devices. Rather, as discussed above, Totino relates to storage chambers, tanks, heat exchangers, mixers, treatment devices and routing devices. Thus, Totino's procedures may not be simply modified

into Sreeram (and to the claims of the present application) as alleged in the Office Action. Thus, independent claim 15 defines patentable subject matter.

Independent claim 31 recites providing a metallic solder in a vacuum chamber under vacuum conditions, heating the metallic solder to at least a melting temperature of the metallic solder while in the vacuum chamber, and providing a pressurized inert atmosphere in the vacuum chamber while the metallic solder is in the vacuum chamber. Independent claim 31 also recites providing the heated metallic solder onto a bonding surface while the metallic solder is in the vacuum chamber, and allowing the heated metallic solder to cool to a temperature less than the melting point of the metallic solder.

For at least similar reasons as set forth above, the applied references do not teach or suggest at least these features of independent claim 31. The Office Action discusses claim 31 on pages 7-9 of the Office Action. Sreeram does not teach or suggest all the features of independent claim 31. For at least similar reasons as set forth above, Totino may not be properly combined with Sreeram. Thus, independent claim 31 defines patentable subject matter.

Accordingly, each of independent claims 1, 15 and 31 defines patentable subject matter. Each of the dependent claims depends from one of the independent claims and therefore defines patentable subject matter at least for this reason. In addition, the dependent claims recite features that further and independently distinguish over the applied references. For example, at least each of claims 10-13, 33-40 and 42-43 relate to features including a vacuum chamber. Sreeram does not teach or suggest at least these features. Additionally, as discussed above, Sreeram may not be modified by Totino as alleged in the Office Action. Accordingly, each of

Serial No. **10/806,118**
Reply to Office Action dated May 8, 2006

Docket No. **INTEL-0069**

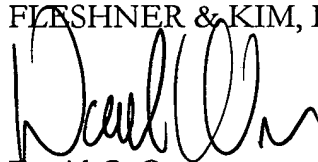
dependent claims 10-13, 33-40 and 42-43 defines patentable subject matter at least for this additional reason.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-17 and 31-43 are earnestly solicited. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned attorney at the telephone number listed below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this, concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
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